

REMARKS

Claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 were previously pending for examination. No claims are currently added, canceled, or amended. As a result, claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 remain pending for examination, with claims 1, 12, 35, 40, and 41 being independent claims. No new matter has been added.

Rejections under 35 U.S.C. § 103

I. Cote in view of Zha and Zha in view of Shimizu and further evidenced by Cote.

Claims 1-3, 6, 9-14, 17, 20-22, 35, 40-42, and 54-56 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Cote et al. (US 2005/0006308, claiming priority to US Provisional Pat. App. No. 60/278,007) (hereinafter “Cote”) in view of Zha et al. (US 2001/0047962) (hereinafter “Zha”).

Claims 1-3, 6, 9-14, 17, 20-22, 35, 40-42, and 54-56 were also rejected under 35 U.S.C. § 103(a) as being unpatentable over Zha in view of Shimizu (US 5,482,625) (hereinafter “Shimizu”) and further evidenced by Cote.

Cote and Shimizu appear to be substantially cumulative with regard to the features disclosed therein which are relied on by the Examiner in support of the above rejections. As such, the rejections over Cote in view of Zha and over Zha in view of Shimizu as further evidenced by Cote will be addressed together.

As a threshold matter, the Examiner has not met the burden of establishing a *prima facie* case of obviousness of any of the claims of the present application. The Examiner uses only conclusory language to state that all of the claims of the present application are obvious over the cited references. The Examiner does not show where each element of each claim of the present application can be found in or can be rendered obvious by the cited references, alone or in combination. As stated in the MPEP § 2143.03, “All words in a claim must be considered in judging the patentability of that claim against the prior art.” To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *Fresenius USA, Inc. v. Baxter Int'l, Inc.*, 582 F.3d 1288 (Fed. Cir. 2009); *In re Royka*, 490 F.2d 981 (CCPA 1974). “The key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious. . . . [R]ejections on obviousness cannot be sustained by mere conclusory statements; instead, there

must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.’ *KSR*, 550 U.S. at ___, 82 USPQ2d at 1396.” MPEP § 2141.

There can be no *prima facie* case of obviousness of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 over Cote in view of Zha, or over Zha in view of Shimizu and further evidenced by Cote because these asserted combinations fail to disclose or suggest each and every element of any of these claims. Further, one of ordinary skill in the art would not have been motivated to have combined Cote and Zha, or Zha and Shimizu in the manner asserted by the Examiner *ab initio*.

A. The asserted combinations of Cote in view of Zha, and Zha in view of Shimizu allegedly further evidenced by Cote, both fail to disclose or suggest a plurality of filtration modules mounted in a common manifold and supplied with a gas/liquid mixture from a single mixing chamber, or an air inlet passing through the manifold and into the mixing chamber from above.

None of Cote, Zha, or Shimizu disclose or contemplate a plurality of membrane modules coupled through a single manifold to a single mixing zone including a single gas inlet as recited in the claims of the present application. As such, no combination of Cote, Zha, and Shimizu can disclose these elements of the claims of the present invention.

Notably, each of Cote, Zha, and Shimizu, alone or in combination, fail to disclose or suggest a manifold coupled to lower headers of a plurality of membrane modules and connected to a single mixing chamber including a single gas inlet constructed and arranged to introduce gas into the mixing chamber from above and through the manifold, wherein the gas inlet is horizontally centered between at least two of a plurality of membrane filtration modules, as recited in independent claims 1 and 35. Each of Cote, Zha, and Shimizu, alone or in combination, fail to disclose or suggest a manifold coupled to the lower headers of a plurality of membrane modules positioned above and connected to a chamber including a gas inlet constructed and arranged to introduce gas into the chamber in a downward direction from above and through the manifold, as recited in independent claim 12. Each of Cote, Zha, and Shimizu, alone or in combination, also fail to disclose or suggest a manifold coupled to a header in which the lower potting heads of a plurality of membrane filtration modules are mounted, the manifold positioned above a mixing chamber including a gas inlet spaced from and surrounded by side

walls of the mixing chamber and configured to feed gas into the mixing chamber from above and through the manifold, as recited in independent claims 40 and 41.

Cote discloses a single membrane module (membrane assembly 1) into which gas is fed by a single gas inlet (air distribution pipe 3) through a single mixing chamber (air box 2). In contrast to the gas inlet structure disclosed in independent claims 1, 12, 35, 40, and 41, Cote discloses a gas inlet which enters a mixing chamber located directly below a membrane module from a horizontal direction. (Cote at FIG. 1 and the discussion thereof). A single mixing chamber is associated with a single membrane module. (Cote at paragraphs [0010] and [0012] and FIG. 1). There is no disclosure or suggestion in Cote of any way in which the disclosed membrane module and mixing chamber could be combined with other membrane modules and mounted in a single manifold, nor any other way in which the air inlet might be introduced into the mixing chamber. Cote does not teach or suggest how multiple membrane modules could have been combined to form a structure including a plurality of membrane modules coupled to a single manifold and mixing chamber including a single air inlet. One of skill in the art would thus have believed that to provide a filtration system including a plurality of membrane modules according to Cote, each membrane module would be provided with its own mixing chamber and air inlet.

Shimizu discloses a submerged flat membrane system having aeration provided by an air inlet (air diffuser 504) located directly beneath a group of flat membrane cartridges 502. (Shimizu FIG. 25). Aeration gas from diffusing ports on the air inlet is directed downward before it travels upward to scour the membranes. (Shimizu at Col. 12, lines 38-40; FIG. 25). The flat membrane cartridges 502 form a single membrane module (the flat membrane cartridges 502 are mounted in a single box frame 501.) (Shimizu FIG. 25). In contrast to the gas inlet structure disclosed in independent claims 1, 12, 35, 40, and 41, and like the air inlet disclosed in Cote, the air inlet disclosed in Shimizu enters a region directly below a single membrane module from a horizontal direction (Shimizu FIGS. 24 and 25). There is no disclosure or suggestion in Shimizu of any way multiple membrane modules (multiple box frames 501) could be mounted together in a single manifold, nor any other way in which the air inlet could be introduced into the membrane module. One of skill in the art would thus have believed that to provide a filtration system including a plurality of membrane modules according to Shimizu, each membrane module would be provided with its own mixing chamber and air inlet.

In contrast to plurality of membrane modules mounted in a single manifold above a mixing chamber including the gas inlet structure disclosed in independent claims 1, 12, 35, 40, and 41, Zha discloses a membrane filtration module in which a “venturi device 12 intakes gas through inlet 13 [and] mixes or entrains the gas with liquid flowing through feed inlet 14” (Zha at paragraph [0041]). In all of the embodiments of the membrane filtration module disclosed in Zha, an air inlet integral to a wall of a venturi device 12 (Zha at FIG.1) which may comprise a jet assembly chamber 16, 57 (Zha at FIGS. 2 and 9), is disclosed as introducing air from a side of the membrane filtration module and perpendicular to an upward flow of feed from a feed inlet. The gas inlet 13 and the mixing chamber are integral to a single membrane module. There is no disclosure or suggestion in Zha that multiple membrane modules could be mounted together in a single manifold and supplied with a liquid/gas mixture from a single mixing chamber or a single gas inlet. One of skill in the art would thus have believed that to provide a filtration system including a plurality of membrane modules according to Zha, each membrane module would be provided with its own mixing chamber and air inlet.

Furthermore, Zha discloses that in some previously known systems, gas is injected by a pressurized blower into a membrane filtration apparatus to form gas bubbles for cleaning the membrane fibers of the apparatus. (Zha at paragraph [0004]). Zha discloses, however, that systems wherein “a gas is injected, usually by means of a pressurised [*sic*] blower, into a liquid system where a membrane module is submerged to form gas bubbles” suffer from several disadvantages. These methods “consume[] large amounts of energy, possibly form[] mist or froth flow reducing effective membrane filtration area, and may be destructive to membranes. Moreover, in an environment of high concentration of solids, the gas distribution system may gradually become blocked by dehydrated solids or simply be blocked when the gas flow accidentally ceases.” (Zha at paragraph [0004].)

Independent claim 1 of the present application recites a filtration apparatus including a plurality of membrane filtration modules mounted in a single manifold and supplied with a gas/liquid mixture from a single mixing chamber below the manifold. The mixing chamber includes a single gas inlet centered between at least two of the plurality of membrane modules. As discussed above, in each of Cote, Zha, and Shimizu, a single membrane module is supplied with an aerating gas from a single chamber associated with the single module in which air is introduced directly below the filtration membranes. None of Cote, Zha, or Shimizu disclose or

suggest any way in which a plurality of the respectively disclosed membrane modules could be mounted together in a common manifold. Nor do any of Cote, Zha, or Shimizu disclose or suggest any way in which the respectively disclosed membrane modules could be supplied with a gas/liquid mixture from a single mixing chamber including a gas inlet passing downwardly through a manifold and positioned in the mixing chamber between at least two membrane modules. Notably, there is no manifold disclosed in the respective apparatus of any of Cote, Zha, or Shimizu through which the claimed air inlet could pass through.

Independent claims 12, 35, 40, and 41 recite similar elements as independent claim 1. For example, independent claim 35 recites a plurality of membrane modules mounted in a manifold above a chamber including an air inlet centered in the chamber to provide a gas/liquid mix to the plurality of membrane modules. The asserted combinations of Cote, Zha, and Shimizu cannot disclose or suggest these elements of independent claims 12, 35, 40, and 41 for the same reason as they cannot disclose or suggest the elements of independent claim 1 discussed above.

As none of Cote, Zha, and Shimizu, alone or in combination, disclose or suggest each and every element of any of independent claims 1, 12, 35, 40, and 41, none of these claims, or the claims which depend from these claims, can be obvious over Cote in view of Zha or over Zha and Shimizu as evidenced by Cote.

B. Neither Cote and Zha, nor Zha and Shimizu allegedly further evidenced by Cote, are properly combinable as asserted *ab initio*.

Neither Cote and Zha, nor Zha and Shimizu would have been combined in the manner asserted by one of ordinary skill in the art.

The Examiner asserts on page 4 of the Office Action that one of ordinary skill in the art would have been motivated to include the air distribution system of Cote into the apparatus of Zha because this would allow air to flow to the roots of the fibers. The Examiner further asserts on page 6 of the Office Action with respect to incorporating the air distribution system of Shimizu into the apparatus of Zha that having an air line into the chamber to provide for the air outlet, and how to place the air line with respect to the header or the membranes would be obvious to one of ordinary skill, and could be designed based on convenience.

Neither of these assertions establishes a valid motivation to combine Cote and Zha, or Zha and Shimizu as asserted by the Examiner.

With regard to the assertion that to include the air distribution system of Cote into the apparatus of Zha would allow air to flow to the roots of the fibers, the Examiner has not shown that this would provide any benefit not already provided by the apparatus of Zha that would have motivated one of ordinary skill in the art to have made this modification. The apparatus of Zha already provides for air/liquid mixing in the mixing chamber and distribution to the various fiber membranes through distribution apertures 10. (Zha FIG. 1 and the description thereof).

Further, to make the asserted modification to Zha would change the principle of operation of the apparatus of Zha (from using a venturi device to mix air into liquid to using a blower to introduce air into liquid), which renders the asserted combination invalid. "If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)." MPEP § 2143.01

As discussed above, Zha discloses that the apparatus that is the subject of his application avoids the disadvantages of prior art systems by providing for the introduction of air into the apparatus through a venturi device rather than the injection of air into the apparatus through blower tubes, as is disclosed in Cote and Shimizu. An advantage of the filtration module disclosed in Zha is to make it "possible to create gas bubbles and aerate the system without a blower" because "[w]hen a motive fluid passes through a venturi it generates a vacuum to draw the gas into the liquid flow and generate gas bubbles therein" (Zha at paragraphs [0041] and [0045]). "By using a venturi device or the like, it is possible to generate gas bubbles to scrub membrane surfaces without the need for a pressurized gas supply such as a blower [which] lowers the cost of operation [of the filtration system]." (Zha at paragraph [0045].)

One of ordinary skill in the art would not have been motivated upon a reading of Zha to have replaced the venturi device of Zha with the air distribution pipe 3 of Cote or to have modified the air nozzle disclosed in Zha so that it was inverted in the fluid flow path, as this would have negated the benefits of using a venturi device as disclosed in Zha. Zha acknowledges that gas may be injected by means of a blower "into a liquid system where a membrane module is submerged to form gas bubbles" as is disclosed in Cote, however criticizes such a method and discloses that such a method gives rise to numerous disadvantages. One of ordinary skill in the art would not have modified Zha as asserted in the Office Action because

this would have resulted in the disadvantages disclosed in Zha without providing any compensating advantage.

As Shimizu, which discloses a similar air introduction system as Cote, was patented years before Zha's application, Zha would have been aware of Shimizu's and Cote's method of introducing air into a filtration apparatus. Yet Zha chose what he believed to be a superior method of introducing gas into his filtration apparatus for use in his invention. One of ordinary skill in the art would not have been motivated upon a reading of Zha and Shimizu and/or Cote to have modified the apparatus of Zha to replace the superior air introduction system disclosed in Zha with the one disclosed in Shimizu which Zha disclosed was inferior.

With regard to the Examiner's assertion that having an air line into the chamber to provide for the air outlet, and how to place the air line with respect to the header or the membranes would be obvious to one of ordinary skill, and could be designed based on convenience, Applicants respectfully disagree. As stated previously, there is no plurality of membrane modules and no manifold disclosed in any of Cote, Zha, or Shimizu which one could place an air line with respect to "based on convenience."

Applying the Examiner's rationale, if one were designing a membrane filtration system including multiple membrane modules according to any of Cote, Zha, or Shimizu, as a matter of "convenience," one would simply include multiple modules as disclosed in Cote, Zha, or Shimizu, each module including its own mixing chamber and air inlet. It would be far less "convenient" to attempt to design a manifold and air distribution system as claimed in the present application and redesign the modules of any of Cote, Zha, or Shimizu to function with such a manifold and air distribution system.

To make a modification to any of Cote, Zha, and Shimizu to provide for the introduction of gas through an air inlet passing through a manifold in which were mounted a plurality of membrane modules as claimed, would require a fundamental restructuring of the apparatus disclosed in any of Cote, Zha, and Shimizu. Such a restructuring would require the design, engineering, and testing of a manifold into which a plurality of the filtration modules disclosed in Cote, Zha, or Shimizu could be mounted. Experimentation would need to be performed to check that, for example, a) no "dead zones" where stagnant fluid could accumulate were present in the newly designed manifold, b) that the manifold would provide for even distribution of fluid and flow rates to each of the modules mounted in it, and c) that adequate flow rates of gas and fluid delivered to the modules could be achieved. Even if such a manifold could be designed, the

inclusion of a plurality of the filtration modules of any of Cote, Zha, and Shimizu would still require multiple air distribution pipes, diffusers, or venturi devices to deliver air to each individual module. Thus, the restructuring would further require the replacement of the single air distribution pipes, diffusers, or venturi devices feeding the individual modules of Cote, Shimizu, and Zha, respectively, with a single air inlet designed to feed a plurality of modules according to Cote, Shimizu, and Zha when mounted together in a common manifold. To perform this restructuring of the apparatus disclosed in any of Cote, Shimizu, and Zha would be far from trivial. Significant experimentation and design work would be required to ascertain whether a single air inlet could adequately provide uniform and effective aeration of a plurality of modules as disclosed in Cote, Shimizu, or Zha when mounted together in a common manifold. It would not be possible for one of skill in the art to predict whether such a restructured configuration of modules according to Cote, Shimizu, or Zha would even be functional for its intended purpose. Even if it were determined that such a reconstructed configuration could be functional, it would require significant work and experimentation to design and configure a common manifold and air inlet for use with a plurality of modules according to any of Cote, Shimizu, or Zha.

One of ordinary skill in the art would not, upon a reading of any of Cote, Zha, and Shimizu have been motivated to have performed such a fundamental restructuring of the apparatus disclosed in these references. There would be no reasonable expectation of success in doing so, this would fundamentally have altered the structure and function of the apparatus disclosed, and there is no suggestion of any benefit to doing so in any of Cote, Zha, and Shimizu.

Thus, the Examiner has not established that there would have been any motivation for one of ordinary skill in the art to have modified either of Cote or Zha in the manner asserted. On the contrary, upon a reading of Cote, Shimizu, and Zha, one of ordinary skill in the art would have been dissuaded from performing the modifications asserted by the Examiner because, as disclosed by Zha, these modifications would have led to numerous disadvantages.

The asserted combination of Cote, Shimizu, or Zha would fails to include each element of any of the claims of the present invention, let alone provides any motivation for combining these elements to form the apparatus recited in the claims of the present application. The only way that the Examiner can combine these references to reconstruct the claims of the present application is through hindsight reconstruction using knowledge gleaned from the present disclosure as a roadmap. This is an impermissible use of hindsight analysis which cannot form

the basis of a valid rejection under 35 U.S.C. § 103. *See Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363 (Fed. Cir. 2008) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 36 (1966)) (discussing “the importance of guarding against hindsight... and resist[ing] the temptation to read into the prior art the teachings of the invention in issue” when considering the obviousness of a patent); *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984); *Ex parte Gilham*, No. 2009-000691 (BPAI Dec. 3, 2009) (reversing an Examiner’s obviousness rejection for using impermissible hindsight and providing only a conclusory statement in support of why one of skill in the art would make an asserted combination of references); MPEP § 2141.01 III.

Because the asserted combinations of Cote and Zha, and Zha and Shimizu cannot disclose or suggest each and every claim element of any of independent claims 1, 12, 35, 40, or 41, and because these references would not have been combined in the manner asserted by one of ordinary skill in the art, independent claims 1, 12, 35, 40, or 41 and the claims that depend therefrom cannot be obvious over Cote in view of Zha or Zha in view of Shimizu and further evidenced by Cote.

Accordingly, reconsideration and withdrawal of the rejection of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 under 35 U.S.C. § 103 over Cote in view of Zha and over Zha in view of Shimizu and further evidenced by Cote is respectfully requested.

II. Zha and/or Cote in view of Shimizu and Henshaw.

Claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 were rejected under 35 U.S.C. § 103(a) over Zha and/or Cote in view of Shimizu, and further in view of Henshaw (US 5,783,083).

There is no *prima facie* case of obviousness of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 over Zha and/or Cote in view of Shimizu, and further in view of Henshaw. The asserted combination of Zha and/or Cote, Shimizu, and Henshaw fails to disclose or suggest each and every element of any of these claims. Further, one of ordinary skill in the art would not have been motivated to have combined these references in the manner asserted *ab initio*.

The Examiner relies on Henshaw for teaching a “plurality of submerged membrane modules arranged in manifolds to have enlarged capacity treatment systems.” The manifolds of Henshaw consist of piping which is used to withdraw permeate (permeate manifolds 135, 155) from multiple membrane skeins and to deliver gas (air supply 145) to multiple membrane skeins.

(See Henshaw FIG. 9). Even in the embodiments of Henshaw in which multiple membrane skeins are utilized in a common filtration tank, aeration gas is still delivered to each individual skein by individual air pipes. Further, these individual air pipes do not pass through any manifold. Henshaw thus discloses a structure which differs significantly from what is claimed in the present application and fails to cure the defect of Zha and/or Cote in view of Shimizu discussed above to disclose or suggest each and every claim element of any of independent claims 1, 12, 35, 40, and 41 and the claims that depend from these claims. For example, the asserted combination of Zha and/or Cote, Shimizu, and Henshaw fails to disclose or suggest a gas inlet constructed and arranged to introduce gas into a single mixing chamber feeding a plurality of membrane modules in a downward direction from above the open base end of the mixing chamber, wherein the gas is fed from above and through a manifold as recited in independent claims 1, 12, 35, 40, and 41 or the claims which depend from these claims.

The reasons why one of ordinary skill in the art would not have been motivated to have combined Cote with Zha, or Zha with Shimizu in the manner asserted by the Examiner are discussed above. These reasons apply equally well to the asserted combination of Zha and/or Cote, Shimizu, and Henshaw.

As such, each of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 is patentable the asserted combination of Zha and/or Cote, Shimizu, and Henshaw. Accordingly, reconsideration and withdrawal of the rejection of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 under 35 U.S.C. § 103 over Zha and/or Cote, Shimizu and Henshaw is respectfully requested.

Provisional Double Patenting Rejection

Claims 1-22, 35, 40-48, and 54-56 were provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over the claims in co-pending Application No. 11/025,418 in view of Shimizu. As noted in Applicants' previous response¹, claims 4, 5, 7, 8, 15, 16, and 19 were previously canceled, rendering the provisional double patenting rejection of these claims moot. Applicants respectfully disagree that any of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 of the instant application should be rejected on the ground of obviousness-type double patenting. Notwithstanding this traversal, Applicants will

¹ Applicants' response filed January 19, 2010.

submit a terminal disclaimer with respect to co-pending Application No. 11/025,418 once the instant claims are deemed allowable.

CONCLUSION

Applicants respectfully request reconsideration of the claims in view of the foregoing amendments and remarks. The application as presented is in condition for allowance. An early and favorable action is respectfully requested. If the Examiner believes, after this Response, that the application is not in condition for allowance, the Examiner is invited to call Applicants' representative at the telephone number listed below.

If this Response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicants hereby request any necessary extension of time. If there is a fee occasioned by this response, including an extension fee that is not covered by an enclosed payment, please charge any deficiency to Deposit Account No. 50/2762 (Ref. No. M2019-7027US).

Respectfully submitted,
Fufang Zha et al., *Applicants*

By: /Gregory K. Gerstenzang/
Peter C. Lando, Reg. No. 34,654
Gregory K. Gerstenzang, Reg. No. 59,513
LANDO & ANASTASI, LLP
Riverfront Office Park
One Main Street
Cambridge, MA 02142
Telephone: 617-395-7019
Facsimile: 617-395-7070

Siemens Docket No.: 2002P87059WOUS
Memcor Docket No.: IPD-C335-US
LL-A Docket No.: M2019-7027US